Uncertainty in Hydrologic Simulations of the Effect of Climate Change in Denmark

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HYACINTS Project

In Denmark, future changes in climate are expected to result in more extreme hydrological conditions. Higher precipitation is predicted in winter resulting in flooding and water logging in low lying areas, whereas reduced precipitation and higher evapotranspiration are predicted during summer resulting in decreasing water tables, dry root zones and reduced low flows in streams. **HY**drological Modelling for **A**ssessing **C**limate Change **I**mpacts at differe**NT** **S**cales (HYACINTS) will develop new methodologies and tools to enable easier and more accurate use of regional scale climate and hydrological models to address local scale water resources problems.

Objective

To assess the uncertainties related to the prediction of climate change effects on water resources at a local scale, considering all sources of uncertainty such as climate scenarios, model structure, model parameters and adaptation scenarios. To evaluate the significance of simulated hydrological change, it is necessary to quantify the uncertainty on both the climate model results and the error propagation through the hydrological model.

Uncertainty

Climate model uncertainty will be analysed using the results of the EU project ENSEMBLES, where uncertainty both in the differences between multiple climate models and the uncertainty of the individual model predictions are quantified. Additional climate model uncertainty will be a function of:

- Greenhouse gas emission scenarios
- Bias-correction methods
- Downscaling methods

The effects of these uncertainties will be combined with the uncertainty in the hydrological model, which is primarily a function of:

- Model scale
- Model structure
- Calibrated parameters

Methods

Quantification of uncertainty on the difference in hydrological variables forced by present and future climate:

- Groundwater heads
- Stream discharge
- Flood frequency
- Wetland inundation
- Evapotranspiration

Analyse the effect of model structure and model scale on the uncertainty by considering multiple model structures:

- Unsaturated zone
- Evapotranspiration
- Land use descriptions

Standard methods will be used to transfer the statistical uncertainty on the parameters to uncertainty on the model results. The effect of simulating at the regional compared to local scale on uncertainty will be analysed in relation to catchment heterogeneity and variability in stresses. Management scenario uncertainty will be investigated by defining different scenarios for groundwater abstraction, irrigation, and land use.

IPCC Emission Scenarios